

WHAT IS CLAIMED IS:

- 1 / 1. An electrostatic discharge protection circuit with high
- 2 trigger current, coupled to a node and a reference
- 3 potential for dissipating the electrostatic voltage
- 4 formed at said node, said electrostatic discharge
- 5 protection circuit comprising:
 - 6 a substrate having a first conductivity type, coupled to
 - 7 said reference potential;
 - 8 a well region having a second conductivity type, formed on
 - 9 said substrate and coupled to said node;
 - 10 a first doping region having said first conductivity type,
 - 11 electrically floated on said well region; and
 - 12 a second doping region having said second conductivity
 - 13 type, disposed on said substrate and electrically coupled
 - 14 to said reference potential;
 - 15 wherein, the electrostatic discharge current of said node
 - 16 provides a voltage with sufficient magnitude to breakdown
 - 17 the conjunction interface between said well region and said
 - 18 substrate, also triggering a BIPOLAR JUNCTION
 - 19 TRANSISTOR (BJT) comprising said well region, said substrate
 - 20 and said second doping region, for dissipating said
 - 21 electrostatic discharge current;
 - 22 and wherein said first doping area, when the electrostatic
 - 23 discharge current is greater than a predetermined current,
 - 24 reduces the potential difference between said node and said
 - 25 reference potential

1 2.The electrostatic discharge protection circuit as claimed
2 in claim 1, wherein said electrostatic discharge protection
3 circuit further comprises a third doping area having said
4 second conductivity type, disposed in said well region,
5 electrically coupled to said node, for forming an ohmic
6 connection at said well region.

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1 3.The electrostatic discharge protection circuit as claimed
2 in claim 1, wherein said electrostatic discharge protection
3 circuit further comprises a forth doping region having said
4 first conductivity type, disposed at the surface of said
5 substrate near said well region, electrically coupled to
6 said reference potential, for forming an ohmic connection
7 at said substrate.

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9 4.The electrostatic discharge protection circuit as claimed
10 in claim 1, wherein said first conductivity is p-type, and
said second conductivity is n-type.

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1 5.The electrostatic discharge protection circuit as claimed
2 in claim 1, wherein said electrostatic discharge circuit
3 further comprises a fifth conductivity type having said
4 second conductivity type, disposed at the conjunction of
5 said well region and said substrate, for reducing the
6 breakdown voltage at the conjunction of said well region
7 and said substrate.

1 6.The electrostatic discharge protection circuit as claimed
2 in claim 1, wherein said electrostatic discharge protection
3 circuit further comprises a field oxide layer, disposed at
4 the surface of said substrate adjacent to said fifth doping
5 region.

Sub A37 7. The electrostatic discharge protection circuit as claimed
in claim 1, wherein said electrostatic discharge protection
circuit further comprises a MOS resistor having a first
conductivity type disposed on said substrate and comprising
a gate and two source/drain regions, wherein one of said
source/drain regions is electrically coupled to said well
region, while the other of said source/drain regions,
together with said gate, is electrically coupled to said
reference potential.

8. The electrostatic discharge protection circuit as claimed
in claim 4, wherein one of said drain/source regions of
said MOS resistor having said first conductivity type is
comprised of said fifth doping region, and the other of
said drain/source regions of said MOS resistor having said
first conductivity type is comprised of said second doping
region.

9. The electrostatic discharge protection circuit as claimed
in claim 7, wherein one of said drain/source regions of
said MOS resistor having said first conductivity type is
comprised of said fifth doping region, and the other of
said drain/source regions of said MOS resistor having said
first conductivity type is comprised of said second doping
region.

10. The electrostatic discharge protection circuit as
claimed in claim 1, wherein said electrostatic discharge
protection circuit further comprises:

a MOS resistor having said first conductivity type, formed
on said substrate, comprising a gate, and two source/drain
regions, wherein one source/drain region is electrically

7 coupled to said well region, and the other source/drain
8 region is electrically coupled to said reference potential;

9 a resistor, its two ends electrically coupled to said gate
10 and said reference potential, respectively; and

11 a capacitor, its two ends electrically coupled to said gate
12 and said node, respectively.

1 11. An electrostatic discharge protection circuit with high
2 trigger current, coupled to a node and a reference
3 potential, for dissipating the electrostatic discharge
4 current from said node, comprising:

5 a BJT, comprising an emitter, a base and a collector,
6 wherein said emitter and said base are electrically coupled
7 to said reference potential, said collector is comprised of
8 a collector region with a second conductivity type and
9 electrically coupled to said node; and

10 a first doping region having a first conductivity type,
11 floated in said collector region, and forms a junction
12 interface with said collector region;

13 wherein said first doping region, when said electrostatic
14 discharge current is greater than a predetermined current,
15 reduces the potential difference between said node and said
16 reference potential.

1 12. The electrostatic discharge protection circuit as
2 claimed in claim 11, wherein said electrostatic discharge
3 protection circuit further comprises a MOS resistor having
4 a first conductivity type, disposed on said substrate,
5 comprising a gate, and two source/drain regions, wherein
6 one of said source/drain regions is electrically coupled to

7 said collector, while the other source/drain region,
8 together with said gate, is electrically coupled to said
9 reference potential.

1 13. The electrostatic discharge protection circuit as
2 claimed in claim 11, wherein said electrostatic discharge
3 protection circuit further comprises:

4 a MOS resistor having said first conductivity type,
5 comprising a gate, and two source/drain regions, wherein,
6 one source/drain regions is electrically coupled to said
7 node, and the other source/drain is electrically coupled to
8 said reference potential;

9 a resistor, its two ends electrically coupled to said gate
10 and said reference potential, respectively; and

11 a capacitor, its two ends electrically coupled to said gate
12 and said node, respectively.

13 14. The electrostatic discharge protection circuit as
14 claimed in claim 11, wherein said first conductivity is p-
15 type, and said second conductivity is n-type.

1 15. The electrostatic discharge protection circuit as
2 claimed in claim 1, wherein said first conductivity is n-
3 type, and said second conductivity is p-type.

4 16. The electrostatic discharge protection circuit as
5 claimed in claim 10, wherein said first conductivity is n-
6 type, and said second conductivity is p-type.

7 / 17. An electrostatic discharge protection circuit with high
8 trigger current, electrically coupled to a node and a
9 reference potential for dissipating the electrostatic

4 voltage formed at said node, said electrostatic discharge
5 protection circuit comprising:

6 a base having a first conductivity type, electrically
7 coupled to said reference potential;

8 a well region having a second conductivity type, formed on
9 said substrate and electrically coupled to said node;

10 a first doping region having said first conductivity type,
11 electrically floated on said well region and electrically
12 coupled to said node; and

13 a second doping region having said second conductivity
14 type, electrically floated on said base;

15 wherein the electrostatic discharge current of said node
16 provides a voltage with sufficient magnitude to breakdown
17 the junction interface between said well region and said
18 base, also triggering a BJT comprising said well region,
19 said base and said first doping region, for dissipating
20 said electrostatic discharge current;

21 and wherein said second doping area, when the electrostatic
22 discharge current is greater than a predetermined current,
23 reduces the potential difference between said node and said
24 reference potential

1 18.The electrostatic discharge protection circuit as
2 claimed in claim 17, wherein said electrostatic discharge
3 protection circuit further comprises a third doping area
4 having said second conductivity type, disposed in said well
5 region, electrically coupled to said node, for forming an
6 ohmic connection at said well region.

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19. The electrostatic discharge protection circuit as
claimed in claim 17, wherein said electrostatic discharge
protection circuit further comprises a forth doping region
having said first conductivity type, disposed at the
surface of said base near said well region, electrically
coupled to said reference potential, for forming an ohmic
connection at said base.

20. The electrostatic discharge protection circuit as
claimed in claim 17, wherein said electrostatic discharge
circuit further comprises a fifth conductivity type having
said second conductivity type, disposed at the conjunction
of said well region and said base, for reducing the
breakdown voltage at the conjunction of said well region
and said base.

21. The electrostatic discharge protection circuit as
claimed in claim 1, wherein said electrostatic discharge
protection circuit further comprises a field oxide layer,
disposed at the surface of said base adjacent to said fifth
doping region.

22. The electrostatic discharge protection circuit as
claimed in claim 1, wherein said electrostatic discharge
protection circuit further comprises a MOS resistor having
a first conductivity type, disposed on said base,
comprising a gate, and two source/drain regions, wherein,
one of said source/drain regions is coupled to said well
region, while the other source/drain region, together with
said gate, is coupled to said reference potential.

23. The electrostatic discharge protection circuit as
claimed in claim 20, wherein ~~one~~ one of said drain/source
regions of said MOS resistor having said first conductivity

4 type is comprised of said fifth doping region, and the
5 other drain/source regions of said MOS resistor having said
6 first conductivity type is comprised of said second doping
7 region.

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8 24. The electrostatic discharge protection circuit as
9 claimed in claim 22, wherein, one of said drain/source
10 regions of said MOS resistor having said first conductivity
11 type is comprised of said fifth doping region, and the
12 other drain/source regions of said MOS resistor having said
13 first conductivity type is comprised of said second doping
14 region.

1 25. The electrostatic discharge protection circuit as
2 claimed in claim 1, wherein said electrostatic discharge
3 protection circuit further comprises:

4 a MOS resistor having said first conductivity type, formed
5 on said base, and comprising a gate and two source/drain
6 regions, wherein one source/drain region is coupled to said
7 well region, and the other source/drain region is coupled
8 to said reference potential;

9 a resistor, its two ends coupled to said gate and said
10 reference potential, respectively; and

11 a capacitor, its two ends coupled to said gate and said
12 node, respectively.

1 26. The electrostatic discharge protection circuit as
2 claimed in claim 17, wherein said electrostatic discharge
3 circuit further comprises a sixth conductivity type having
4 said first conductivity type, disposed at the conjunction
5 of said well region and said base, for reducing the

6 breakdown voltage at the conjunction of said well region
7 and said base.

1 27.The electrostatic discharge protection circuit as
2 claimed in claim 26, wherein said electrostatic discharge
3 protection circuit further comprises a field oxide layer,
4 disposed at the surface of said well adjacent to said sixth
5 doping region.

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1 28.The electrostatic discharge protection circuit as
2 claimed in claim 27, wherein said electrostatic discharge
3 protection circuit further comprises a MOS resistor having
4 a second conductivity type, disposed on said well region,
5 comprising a gate and two source/drain regions, wherein one
6 of said source/drain regions is electrically coupled to
7 said base, while the other source/drain region, together
8 with said gate, is electrically coupled to said node.

1 29.The electrostatic discharge protection circuit as
2 claimed in claim 18, wherein, one of said drain/source of
3 said MOS resistor having said second conductivity type is
4 comprised of said sixth doping region, and the other
5 drain/source of said MOS resistor is comprised of said
6 third doping region.

1 30.The electrostatic discharge protection circuit as
2 claimed in claim 28, wherein, one of said drain/source of
3 said MOS resistor having said second conductivity type is
4 comprised of said sixth doping region, and the other
5 drain/source of said MOS resistor is comprised of said
6 third doping region.

1 31.The electrostatic discharge protection circuit as
2 claimed in claim 26, wherein said electrostatic discharge
3 protection circuit further comprises:

4 a MOS resistor having said second conductivity type,
5 comprising a gate, and two source/drain regions, wherein,
6 one source/drain region is electrically coupled to said
7 node, and the other source/drain region is electrically
8 coupled to said reference potential;

9 a resistor, its two ends electrically coupled to said gate
10 and said node, respectively; and

11 a capacitor, its two ends electrically coupled to said gate
12 and said reference voltage, respectively.

1 32. The electrostatic discharge protection circuit as
2 claimed in claim 17, wherein said first conductivity is p-
3 type, and said second conductivity is n-type.

1 33. The electrostatic discharge protection circuit as
2 claimed in claim 17, wherein said first conductivity is n-
3 type, and said second conductivity is p-type.

Sub 17 34. An electrostatic discharge protection circuit with high
1 trigger current, electrically coupled to a node and a
2 reference potential for dissipating the electrostatic
3 voltage formed at said node, said electrostatic discharge
4 protection circuit comprising:
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6 a BJT, comprising an emitter, a base and a collector,
7 wherein said emitter and said base are electrically coupled
8 to said node, said collector is comprised of a collector
9 region with a first conductivity type and electrically
10 coupled to said reference potential; and

11 a second doping region having a second conductivity type,
12 floated in said collector region, and forms a conjunction
13 interface with said collector region;

14 wherein said second doping region, when said electrostatic
15 discharge current is greater than a predetermined current,
16 reduces the potential difference between said node and said
17 reference potential.

1 35.The electrostatic discharge protection circuit as
2 claimed in claim 34, wherein said electrostatic discharge
3 protection circuit further comprises a MOS resistor having
4 a first conductivity type, comprising a gate, and two
5 source/drain, wherein, one of said source/drain is
6 electrically coupled to said collector, while the other
7 source/drain region, together with said gate are
8 electrically coupled to said reference potential.

36.The electrostatic discharge protection circuit as
claimed in claim 34, wherein said electrostatic discharge
protection circuit further comprises:

4 a MOS resistor having said first conductivity type,
5 comprising a gate, and two source/drain , wherein, one
6 source/drain is electrically coupled to said node, and the
7 other source/drain is electrically coupled to said
8 reference potential;

9 a resistor, its two ends are respectively electrically
10 coupled to said gate and said reference potential; and

11 a capacitor, its two ends are respectively electrically
12 coupled to said gate and said node.

1 37. The electrostatic discharge protection circuit as
2 claimed in claim 11, wherein said first conductivity is p-
3 type, and said second conductivity is n-type.